Gonidia of lichens.—In 1905 ELFVING, of the University of Helsingsfors, published his studies, which he thought disproved the recent view that the chlorophyllous elements associated with lichens are algae. He continued his work and published his results in 1913. In the interval DANILOV[6] began studies which disproved ELFVING'S conclusions. DANILOV'S results were published in Russian in 1910 and in English in 1918.[7] ELFVING'S conclusion was that the lichen hyphae threw out spherical cells, at first colorless, but later colored and very similar to algae. These he supposed became separated from the hyphae and divided rapidly within the lichen thallus, forming, according to his results, the "gonidia" of lichens. Reviewing these results, DANILOV found on careful study that unstained preparations often left the impression that the algal cells might really be outgrowths of the lichen hyphae, with which they are intimately associated. By the use of stains, however, he was able to trace the entrance of the hyphae into the algal cells, thus proving that there is no genetic relationship, but that the relationship is rather that of host and parasite. The "pale gonidia" of ELFVING were found to be dead algae which had been killed by the parasitic lichen, and DANILOV was able to see distinctly the lichen hyphae within them.

Important and quite apart from the refutation of the once generally accepted view of the origin of the chlorophyllous "gonidia" from the non-chlorophyllous lichens, are the conclusions of DANILOV regarding the relation of the lichen to its algal host. He admits that there may be osmotic filtration of certain materials from the alga to the lichen, and the like passage of others from the lichen to the alga. However this may be, DANILOV finds the final result to be the absorption of the algae by the lichen hyphae, which enter the algal cells and form dense networks of slender, thin-walled or naked absorbing threads. Although the lichen thallus with its prepared peptones and certain other organic materials is probably a favorable substratum for the algae, yet the lichen is parasitic on the algae, which are killed in large numbers as a result of the parasitism. On the whole the algae thrive better outside the association with the lichen, while the lichen does poorly or dies outright outside the association.—BRUCE FINK.

Sex organs of Phytophthora.—In 1913 PETHYBRIDGE,[8] studying a disease of the potato produced by a phycomycetous fungus which he named *Phytophthora erythroseptica*, observed that on the formation of the sexual organs of this

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[6] DANILOV, A. N., Über das gegenseitige Verhältnis zwischen den Gonidien und dem Pilzkomponten der Flechtensymbiose. Bull. Jard. Imp. Bot. St. Petersb. 10:33–70. *pls. 3. figs. 9.* 1910.

[7] ———, The relation between the gonidia and the hyphae in lichens. Jour. Botany 56:169–181. 1918.

[8] PETHYBRIDGE, G. H., On the rotting of potato tubers by a new species of *Phytophthora* having a method of sexual reproduction hitherto undescribed. Sci. Proc. Royal Dublin Soc. 13:529–565. *pls. 3.* 1913.

fungus the oogonial hypha pushes its way entirely through the antheridium, and, after emerging on the side opposite to the point of entrance, enlarges to form the oogonium. This unusual process, together with the subsequent events in the formation of the oospore, has now been more fully investigated by MURPHY,[9] whose cytological evidence bears out the observations of PETHYBRIDGE. The antheridia and oogonia are found to arise on different branches of the mycelium. During the penetration of the antheridium by the oogonial incept no fusion of the cytoplasm of the two organs occurs. After its emergence the oogonial hypha develops into a more or less spherical multinucleate oogonium whose stalk passes through the antheridium. When the sexual organs have reached their full size, about two-thirds of the nuclei in the antheridium and in the oogonium degenerate. The remaining nuclei in both organs then divide once mitotically and simultaneously. During the division the nuclei of the oogonium are arranged in a hollow sphere, with the exception of one, which remains in the center. Immediately after the division the protoplasm of the oogonium separates into a vacuolate hyaline ooplasm and a denser periplasm. In the oogonium, and probably in the antheridium also, all the nuclei but one degenerate. During this period a prominent receptive papilla protrudes from the base of the oogonium into the antheridium. When the receptive papilla is withdrawn, the fertilization tube grows into the oogonium at the same point and discharges one nucleus and the greater part of the cytoplasm of the antheridium into the oogonium. With the completion of this process most of the periplasm has disappeared and the oospore is surrounded by a thin membrane with the last vestiges of the degenerating nuclei appressed against its outer surface. The fusion of the two nuclei does not take place until the thickened oospore wall has been completed.—H. HASSELBRING.

Action of neutral salts on acid inversion of cane sugar.—LEBERT[10] has studied the action of neutral salts on the acid inversion of cane sugar. His results furnish him a basis for a chemical explanation of certain difficulties sometimes encountered when attempts are made to invert cane sugar by means of weak acids or stronger acids in quantity just sufficient to effect the inversion. Solutions in which it is desired to invert cane sugar are rarely free from neutral salts, especially sodium acetate left in the solution after clearing with lead acetate and removing the excess of lead with sodium carbonate or sulphate. If the hydrolysis is effected by a relatively large quantity of strong acid, as in the Clerget method, the presence of a small amount of salt is of little consequence, since the H ions are in great excess. If organic acids are employed, the presence of their sodium or potassium salts will retard the rate of inversion,

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[9] MURPHY, P. A., The morphology and cytology of the sexual organs of *Phytophthora crythroseptica* Pethyb. Ann. Botany **32**:115–153. *pls. 3.* 1918.

[10] LEBERT, M., Action des sels neutres sur l'inversion du sucre par les acides. Rev. Gen. Botanique **30**:241–244. 1918.